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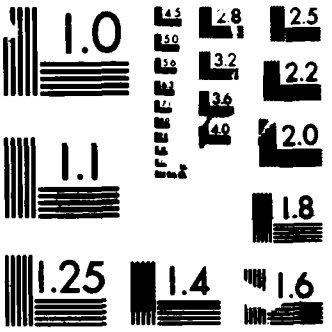

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IDENTIFICATION AND IMPORTANCE OF FACTORS IN COMPONENT BREAKOUT AND HIGH DOLLAR VALUE SPARE PART BREAKOUT DECISIONS

THESIS

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AFIT/GLM/LSY/87S-33

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THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

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Abstract

The purpose of this study was to investigate why component breakout is not more extensively used as a cost saving technique in U.S. Air Force procurements. To accomplish this a review of the literature, and component breakout documentation maintained at Aeronautical Systems Division (ASD) was completed. These reviews resulted in a composite list of twelve factors used to justify a non-breakout decision. Sixteen System Program Office (SPO) directors were then asked to consecutively rank the factors in order of importance to a breakout decision. A rank of one was given to the most important factor with the least important receiving a rank of twelve. Overall importance was then determined by summing the ranks given to each factor. The factor with the lowest sum was considered to be most important and so on until the factor with the highest sum was identified as the least important.

A nonparametric statistical test was conducted on this ranked data to determine the level of agreement between the SPO directors of the relative importance of each factor. The results of this test indicated a high level of agreement among the SPO directors on the overall importance of each factor in a breakout decision.

The most important recommendation produced from this study was that the Air Force must provide greater incentives to SPO directors to more aggressively pursue an active component breakout program. Only through increased high level support will the considerable cost savings available through component breakout be fully realized.

IDENTIFICATION AND IMPORTANCE OF FACTORS IN COMPONENT BREAKOUT AND HIGH DOLLAR VALUE SPARE PART BREAKOUT DECISIONS

I. Introduction

General Issue

Defense policy pressure for continuing advancement in the state of the art has continued to increase the high cost of weapons system acquisition. From 1982 to 1986, Department of Defense (DoD) expenditures for equipment and supplies reached nearly 2 trillion dollars (19:1-2). These high costs have resulted in a great amount of Congressional emphasis on the use of contracting methods that offer cost savings to the government (13:2). One such method is component breakout. As described in the DoD Federal Acquisition Regulation (FAR) Supplement, component breakout occurs when the government purchases a component previously procured as contractor furnished equipment (CFE) and provides it to the prime contractor for incorporation in the end item (10:17202-1). Component breakout decreases weapon system cost through elimination of prime contractor surcharges such as profit, growth and usage, and material handling (11:1-2). In addition to the breakout of end item components, great savings can also be realized in the breakout of high dollar value spare parts. The U.S. Senate Committee on Govern-

mental Affairs reported:

> For example, an Air Force program office memorandum for the B-1 bomber which we have obtained, indicates that over $500 million--half a billion dollars, and that is not even peanuts in Washington--could be saved if spare parts for the B-1 were bought directly from the manufacturers rather than through the prime contractor (20:6).

In spite of the magnitude of savings available, the tendency in DoD procurement is to justify why breakout cannot be accomplished, rather than taking time and effort to accomplish more breakout activity (18:336). "Component breakout and high dollar spare parts breakout programs need a great deal of attention because significant potential savings are not being realized" (18:336).

Background

Due largely to Congressional concern over rising weapon system costs, the Air Force began it's effort to develop a component breakout program in the late 1950's (13:1). Through the years, again greatly dependent on the amount of Congressional emphasis, breakout activity and policy has continued to evolve. Current DoD policy with regard to component breakout is described as follows:

> 1. Whenever it is anticipated that the prime contract for a weapons system or other major end item will be awarded without adequate price competition, and the prime contractor is expected to acquire a component without such competition, it is Department of Defense policy to break out that component if:
>
> (a) substantial net cost savings will probably be achieved; and

(b) such action will not jeopardize the quality, reliability, performance or timely delivery of the end item.

2. The desirability of breakout should also be considered (regardless of whether the prime contract or the component being acquired by the prime contractor is on the basis of price competition) whenever substantial net cost savings will result (1) from greater quantity acquisitions or (2) from such factors as improved logistics support through reduction in varieties of spare parts and economies in operations and training through standardization of design. Primary breakout consideration shall be given to those components of the end item representing the highest annual acquisition costs and offering the largest potential net savings through breakout (10:17202-2).

The System Program Office (SPO) is responsible for component breakout selection, review, and decision process. Within each SPO, a team of experts is designated to review all procured equipment for possible breakout potential. The team is headed by a program manager, project officer, or program director and staffed by a project team which includes the following members: a small business specialist, cognizant engineering, production, logistics, maintenance, pricing, contracting, and other individuals as appropriate for the component under consideration (10:17202-3). The DoD Inspector General (IG) provides further regulatory interpretation on breakout activity:

> Normally, components of a system should be reviewed annually for breakout when the expected cost is $1 million or more. The FAR identifies circumstances that could preclude breakout of components, but indicates that the acquiring activity should eliminate these circumstances if feasible. The regulation also requires the activity to maintain documentation showing evidence that breakout reviews were performed.

> The documentation should include a list of components reviewed and show those components that have no potential for breakout, those that are susceptible to breakout, and those for which a decision on breakout has been made (11:2).

In addition, Air Force Systems Command Regulation /Air Force Logistics Command Regulation (AFSCR/AFLCR) 800-31 requires all AFSC product divisions to submit annual reports on component breakout activity to HQ AFSC for review (5:54).

Despite all Congressional emphasis and regulatory requirements governing breakout activity, numerous inspecting agency reports cite deficiencies in the Air Force's breakout programs. Air Force Audit Agency (AFAA) Summary Report of Audit (SRA) entitled Component Breakout In Weapon System Acquisition stated:

> Overall, the component breakout program within the Air Force could be more effective. There was a wide range in the extent of program implementation among the system program offices. Three program offices reviewed had effective, aggressive component breakout programs and estimated, at the time the breakout decisions were made, savings of $113 million to $138 million. However, six other program offices reviewed did not aggressively pursue a component breakout program. Based on a selective review of contractor furnished equipment, we identified possible candidates for breakout within the F-15, F-16, A-10, B-52, and TRI-TAC Troposcatter program offices which were brought to management's attention in local reports. The following conditions in the Air Force component breakout program existed.
>
> a. Concern over the disadvantages of component breakout has led to fewer breakout decisions than possible. Program offices generally stressed (1) increased workload without an increase in assigned manpower, (2) Contractor furnished equipment/government furnished equipment integration problems, and (3)

configuration management difficulties, rather than following FAR requirements to consider the feasibility of eliminating conditions unfavorable to breakout.

b. Lack of standard Air Force guidelines for preparing cost analyses to support decisions for or against breakout have resulted in one program office overestimating offset costs, a second program office not considering potentially significant offset costs, and a third program office not performing timely cost analyses. Further, we were unable to determine the cost analysis methodology used by four remaining program offices because documentation was not maintained (4:2-3).

AFAA SRA on the Acquisition Management Of The Advanced Medium Range Air-To-Air Missile (AMRAAM) found:

> The AMRAAM program manager had not initiated a component breakout program. Specifically, the program manager had not established a breakout review committee to evaluate the potential breakout of contractor furnished equipment for the FY 1987 production option or planned follow-on buys. Contracting and manufacturing personnel at the program office stated that use of a leader/follower acquisition strategy eliminated the need for component breakout, and component breakout would not be cost effective because of added personnel costs. In addition, program office personnel questioned whether the prime contractor would retain total system performance responsibility for those missiles having Government furnished components. However, our analysis showed that these considerations do not eliminate the potential for component breakout. We identified eight components with breakout potential from which over $17.8 million in gross savings could be realized for AMRAAM procurements planned during FYs 1987-1989 (1:5-6).

AFAA SRA detailing Acquisition Management And Installation Management In The KC-135/CFM56 Reengine Program reported:

> The KC-135 system manager had not initiated an effective component breakout program for the KC-135/CFM56 reengine modification. The system manager had not established a break-

out review committee to evaluate the potential breakout of contractor furnished equipment for the fiscal year 1984 production contract. Except for HQ AFLC directed breakout of the CFM56 engine, breakout of the reengining kit components was not pursued. Management of OC-ALC believed the personnel required to manage the additional acquisition efforts resulting from breakout would not be available. With a breakout program, over $40 million in gross savings could be realized for the procurements planned during fiscal years 1984-1989 (2:4).

The DoD IG in its review of Component Breakout Program For The F-15 Aircraft said:

> The component breakout program for the F-15E aircraft can be improved. The F-15 System Program Office identified 22 parts to be broken out in FY 1986 with an estimated cost savings of $3.9 million over the remaining procurement life. However, 52 additional subcontracted parts were candidates for breakout. At the time of the audit, the Air Force supply system purchased 48 of the 52 parts as replenishment spares. These parts remained contractor-furnished equipment because the SPO did not: develop and maintain an accurate list of candidates for breakout; update and document technical assessments from in-house engineers; obtain price quotes from subvendors before deferral decisions; initiate actions to overcome excessive administrative and production lead times; or adequately document decisions. The F-15 SPO could avoid prime contractor surcharges of $63.4 million over the remaining F-15E procurement life if the 52 parts were broken out. In addition, 20 of the 48 parts purchased by the supply system had assets in excess of calculated requirements that could have been used to satisfy F-15E production needs at an additional savings of $11.9 million (11:5).

In the area of spare parts breakout, AFAA SRA on Pricing Replenishment Spare Parts revealed:

> In spite of this intensified screening, our review disclosed that 58 of the 175 randomly selected replenishment spare parts were overpriced approximately $238,800 because: (i) they were purchased from a prime contractor rather

than the actual manufacturer; or (ii) ALC buyers, in isolated instances, did not obtain information which, in retrospect, was needed to obtain the best available price (7:5).

Finally, AFAA SRA entitled Pricing Initial Spare Parts reported:

> Boeing. Seventeen of the 100 initial spare parts reviewed were overpriced by $13,550 due to purchasing uneconomical quantities; procuring common, standard, or bulk items from the prime contractor instead of from the manufacturer; provisioning NSN items; and various pricing errors on subcontracted items.
>
> General Dynamics. Twenty-four of the 100 initial spare parts reviewed were overpriced by $35,588. Primary causes were provisioning NSN items, needlessly procuring items through anotner General Dynamics division, purchasing uneconomical quantities, provisioning urgent spares requirements, and various pricing errors on subcontracted items (6:5).

As the above examples indicate, millions of acquisition dollars continue to be sacrificed due to poorly managed or non-existent breakout programs. Although these reports have provided some insight on possible disadvantages of breakout, a tragic reason for much of this waste may be simple indifference (20:7). Contracting personnel find it easier to let tne prime contractor order equipment, even if it is 25% to 50% more expensive (20:7). As the cost of national defense continues to increase, everything possible must be done to assure this money is wisely and efficiently spent. Improved component and spare part breakout programs would suostantially reduce the high cost of weapons system acquisition.

Statement of Problem

To reduce costs, regulations require SPOs to annually review all procured equipment for breakout potential. While this requirement is meant to ensure all SPOs establish and maintain an effective breakout program, numerous inspecting agency reports conclude breakout activity within the Air Force is not effective. Why this program deficiency exists is the subject of this research.

Research Objective

The purpose of this research is to identify and prioritize the causal factors behind deficient component breakout programs, and high dollar value spare part breakout programs.

Research Questions

1. What factors are associated with the ineffective component and spare part breakout programs?

2. What factors are most important in the development of a breakout decision?

Scope and Limitations

This research effort is limited to the study of components of major weapon systems and high dollar value spare part acquisition. The research will be entirely conducted and based on data collected from Aeronautical Systems Division (ASD). The researcher has found that ASD accounts for more than 60% of AFSC's total breakout activity. Conse-

quently, the data and resources needed to accomplish the research objective are readily available at ASD.

II. Literature Review

Overview

This chapter will establish a foundation for understanding the development of component and spare part breakout in the Air Force, as well as other military services. To accomplish this task, a historical perspective of happenings and events relating to breakout will be presented. Specific emphasis will be placed on significant changes in the weapons system acquisition environment that have greatly affected the breakout process.

Historical Perspective

During the 1930's and 1940's, weapons system simplicity allowed government agencies to buy many items directly from specialist vendors and supply them as government furnished equipment (GFE) to prime contractors. As weapons system sophistication and complexity continued to increase, more and more components had to be specially designed and carefully integrated into an overall system plan. It became quickly apparent that this overall integration responsibility must be given to some single organization. As government agencies frequently lacked the necessary technical skills, this integration task was in most cases delegated to the prime contractor (15:103).

> In this role the weapon system prime contractor subcontracted (and received a profit override on) components which earlier procurement

methods would have been purchased directly by a government agency (15:103).

Breakout Begins. By the late 1950's, procurement agencies began to notice the increased cost of weapon systems caused by this prime contractor "middleman" integration responsibility. It also became clear that as a program reaches the stage of fairly stable production, the systems integration role loses much of its importance. With this realization in mind, government agencies led by the Army, began breaking out items for direct procurement and providing them to prime contractors as GFE (15:103-104).

Breakout in the 1960's. Early success of the Army's breakout programs soon led to congressional insistence that the Air Force and Navy initiate their own breakout programs in the late 1950's and early 1960's. Throughout the 1960's, Secretary of Defense (SECDEF) Robert F. McNamara strongly advocated further breakout program development. Under his direction, component breakout planning became part of the military services procurement planning program. Also, requirements were set in motion to acquire technical data packages so that maximum competition could be sought during the breakout process (13:17). Depending on the acquisition strategy, breakout increases competition in the acquisition process as depicted in Figure 1.

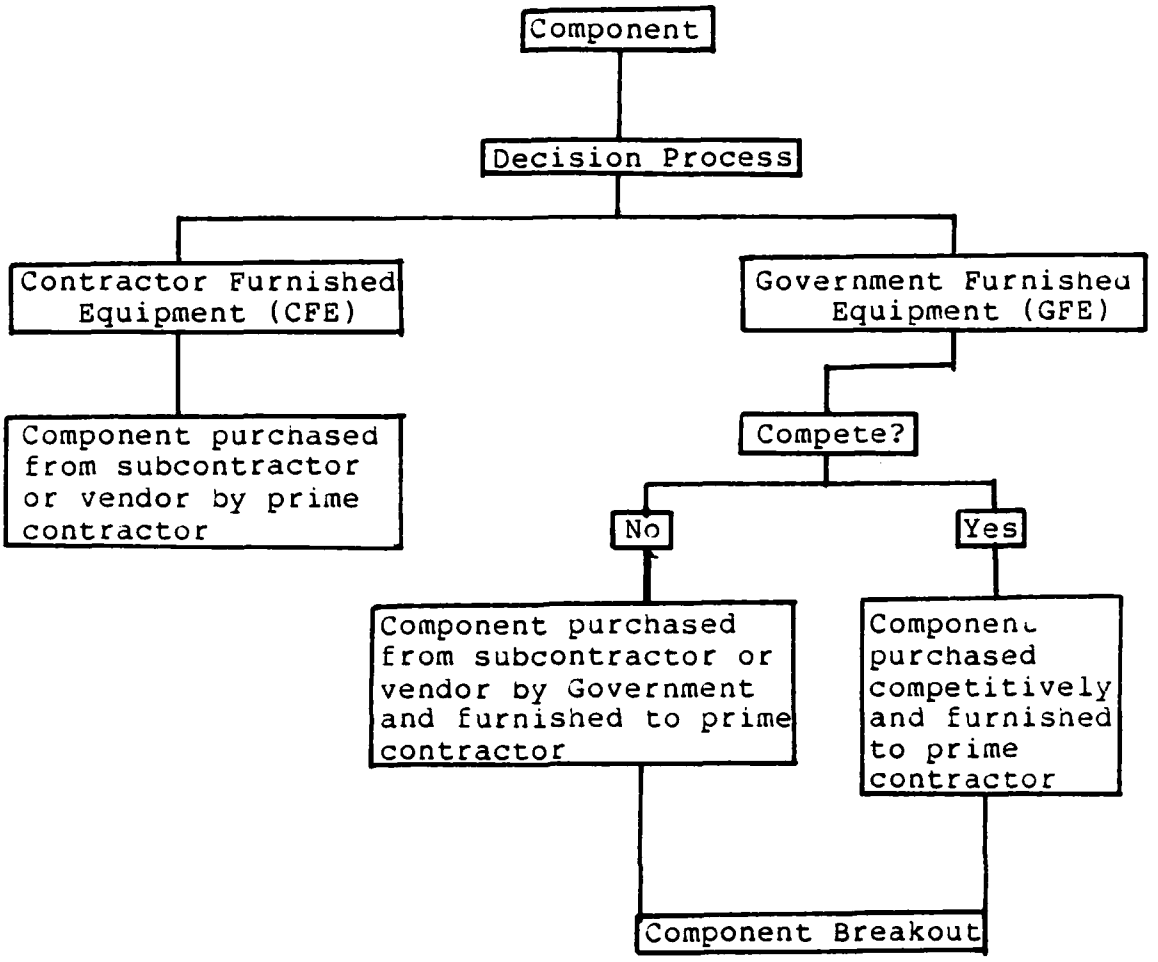

Figure 1. CFE vs. GFE

Despite the fact that the DoD did not issue a formal regulation covering its component breakout policy until 1 December 1965, considerable breakout activity took place during the 1960's. In 1965 for example, the Navy converted 43 components to GFE in the P-3, H-46, F-4, and A-6 aircraft programs at reported savings of 19.2 million dollars (13:18).

Breakout in the 1970's. As we continued into the 1970's, component breakout activity began to subside. Many

of the procurement policies established during the "McNamara Era" were under congressional challenge. As a result, a great reduction in the degree of emphasis placed on component breakout became very apparent. Program managers were complaining that breakout activities of the 1960's had charged them with total responsibility of complex equipment which they lacked technical expertise and personnel to manage. Although the regulatory breakout policy of the 1960's remained intact, minimum breakout took place in the military throughout the 1970's (13:20).

This minimal response to breakout soon drew the attention of inspecting agencies in both the Air Force and the Army. An AFAA SRA review of breakout practices in the F-15 SPO stated: (1) the SPO had not identified all components with breakout potential and had not adequately prepared items for breakout; and (2) had insufficiently documented the need to defer breakout of 15 candidate items, reviewed in 1974 and 1975 (13:20).

Similar breakout deficiencies were also being reported in the mid 1970's by the Army Audit Agency (AAA). These reports stated that breakout was receiving very little attention throughout the Commands, and as a result, a great potential for savings was being discarded (9:1).

Due to AAA reports mentioned above, the Command Group, United States Army Aviation Systems Command (USAAVSCOM), directed the Systems Analysis Office, AVSCOM, to perform an

in-depth study of the Commands' Component Breakout Program. This major breakout study produced the following findings:

a. AVSCOM has no active Component Breakout Program.

b. Armed Services Procurement Regulation (ASPR) paragraph 1-326 and Aviation Systems Command Regulation (AVSCOMR) 700-32 offer a feasible procedure for operating a fruitful Component Breakout Program.

c. AVSCOMR 700-32 does not assure full compliance with ASPR paragraph 1-326, "Component Breakout Program," July 1974.

d. AVSCOMR 700-32 does not assign or delineate the duties and responsibilities for a single point-of-contact for the Component Breakout Program.

e. AVSCOM personnel are not aware of the differences between the Component Breakout Program and Spare Parts Breakout Program.

f. Conversion from CFE to GFE produces a fertile area for savings to the government.

g. Estimated savings from the Component Breakout Program will fund its operation and measurably reduce a weapon system's life cycle cost.

h. Organizational structure enhancements to the Component Breakout Program will produce increased visibility and improved accountability (9:16).

These findings not only document the fact that breakout activity was virtually non-existant within AVSCOM but also indicated a serious lack of education about the breakout process in general.

As a result, the AVSCOM report also published a general decision-making process to aid breakout personnel in the identification and selection of breakout components. This process took the form of the following 12 question checklist:

1. Are the design of the component (and the design of the end-item insofar as it will affect the component) sufficiently stable that further design or engineering effort by the end-item contractor in respect to the component is unlikely to be required?

2. Is a suitable data package available with rights to use it for Government procurement?

3. Can any problems of quality control and reliability of the component be resolved without requiring effort by the end-item contractor?

4. Is it anticipated that requirements for technical support (i.e., functions such as development of proposed detailed specifications; development of test requirements to prove design adequacy or compliance with design; monitoring tests to assure compliance with established requirements; definition of quality assurance requirements for production of articles; and analysis and correction of service-revealed deficiencies) heretofore performed by the end-item contractor will be negligible? If not, does the Government have the resources (manpower, technical competence, facilities, etc.) to provide such support, or can such support be obtained from the end-item contractor (even though the component is broken out) or other source?

5. Can breakout be accomplished without causing unacceptable difficulties in logistics support (e.g., by jeopardizing requisite standardization of components)?

6. Can breakout be accomplished without causing over fragmentation of the end-item that might materially impede administration, management, and performance of the end-item contract (e.g., by unduly complicating production of scheduling or identifying and fixing responsibility for end-item failure that may be caused by a defective component)?

7. Can breakout be accomplished without jeopardizing delivery requirements of the end-item?

8. If a decision is made to break out a component and to acquire it from a new source, can advance procurement funds be made available to provide that source any necessary additional lead time?

9. Is there a source other than the present manufacturer capable of supplying the component?

10. Has the component been (or is it known that it is going to be) purchased directly by the Government as a support item in the supply system or as GFE in other end-items?

11. Would the financial risks and other responsibilities being assumed by the prime contractor, that will have to be assumed by the Government if the item is broken out, be acceptable?

12. Will breakout result in substantial net cost savings? Estimates of probable savings in cost, should be developed for each case on its own facts, with consideration given to any estimated offsetting costs such as increases in the cost of requirements determination and control, contracting, contract administration, data package purchase, material inspection, qualification or pre-production testing, ground support and test equipment, transportation, security, storage, distribution, and technical support (9:7-9).

This checklist provided AVSCOM personnel a structured decision making process to promote understanding and hopefully generate breakout activity. In addition, the AVSCOM review provided a new organizational structure to manage the Commands component breakout programs. This structure identified a GFE coordinator, or the individual responsible for the component breakout for each weapon system. Consequently, due largely to the AVSCOM study, both visibility and accountability of component breakout was on the rise as we concluded the 1970's.

Breakout in the 1980's. The reduced military budgets of the Carter administration and the resulting deterioration of U.S. military strength became selfevident as we entered the 1980's. President Reagan's commitment to improve national defense and increase military spending placed high level attention on existing weapon system acquisition procedures. Particular interest centered on the acquisition and apparent overpricing of spare parts. In May 1983, the Air

Force Management Analysis Group (AFMAG) was formed to study this issue.

The Secretary of the Air Force and the Air Force Chief of Staff directed the formation of the AFMAG on 20 May 1983. The group's charter was to conduct an in-depth formal review of the entire spare parts and weapon system acquisition process, and recommend changes to resolve the apparent overpricing problem. The study began on 14 June 1983 and was completed with the formal report issued on 12 October 1983. This report contained 159 recommendations to correct problems dealing with Air Force acquisition. Several problems sited deal specifically with overpriced parts resulting from poor breakout management. Some examples were:

a. There is no standard Air Force policy for acquiring Acquisition Data Packages and rights in technical data in a competitive environment. This has impeded the ability of the Air Force to competitively breakout and acquire spare parts.

b. Engineering data containing unauthorized limited rights legends is accepted by the Air Force, which inhibits breakout when acquiring spare parts.

c. A lack of adequate understanding of the interface between Logistics Support Analysis (LSA), and Provisioning Technical Documentation (PTD) requirements has resulted in a duplication of technical information provided to support the provisioning process. This increases program costs and results in missed opportunities to breakout spare parts for increased competition.

d. Inadequate attention is paid to spare parts competition, breakout, and pricing during systems acquisition source selections. The AFMAG recommends breakout should become a ranked source selection criteria.

e. Lack of a comprenensive, accountable organization at the Air Logistics Centers responsible for spare parts breakout and for ensuring a fair and reasonable price for each spare part, has resulted in some parts overpricing and inadequate competition (8:40-168)

The main thrust of the AFMAG report was that spare parts breakout, leading to competitive reprocurement, should continue throughout the life of the system. To this end, the report identified a lack of manpower, and the ability to motivate personnel associated with the acquisition process, as the major restrictions. From 1973 to 1979, AFLC lost over 22,000 personnel authorizations. This in combination with the large increase in defense spending in the early 1980's, greatly increased the workload of existing personnel, and adversely affected the amount of time available to train these people. For these reasons, the AFMAG report recommended the establishment of a functional award to recognize excellence for increasing breakout and spare parts competition. The report also recommends that the management rating system for the ALC organizations be restructured to place a more balanced evaluation of an organization's effectiveness in relation to quality pricing, negotiation effectiveness, and expansion of breakout and effective competition (3:16-18).

The final major event in the chronology of breakout was the congressional approval of the Small Business and Federal Procurement Competition Enhancement Act on 30 October 1984. This Act, also known as Public Law 98-577, had as a major provision the establishment within the Small Business Administration (SBA), of a breakout procurement center representative for each major DoD installation purchasing more than

$150 million in non-commercial items per year. The responsibility of the breakout representative is to advocate the breakout of items for competitive procurement. To accomplish this tasking, breakout representatives are authorized to:

a. attend any provisioning conference or similar session during which determinations are made as to whether requirements are to be procured through other than full and open competition and make recommendations with respect to such requirements to the members of such conference or session;

b. review, at any time, restriction on competition previously imposed on items through acquisition method coding or similar procedures, and recommend to personnel of the appropriate activity the prompt reevaluation of such limitations;

c. review restrictions on competition arising out of restrictions on the rights of the United States in technical data, and, when appropriate, recommend that personnel of the appropriate activity initiate a review of the validity of such an asserted restriction;

d. obtain from any governmental source and make available to personnel of the appropriate activity, unrestricted technical data necessary for the preparation of a competitive solicitation package for any item of supply or services previously procured noncompetitively due to the unavailability of such unrestricted technical data;

e. have access to the unclassified procurement records and other data of the procurement center;

f. receive unsolicited engineering proposals and, when appropriate (i) conduct a value analysis of such proposal to determine whether such proposal, if adopted, will result in lower costs to the United States without substantially impeding legitimate acquisition objectives and forward to personnel of the appropriate activity recommendations with respect to such proposal, or (ii) forward such proposal without analysis to personnel of the activity responsible for reviewing

such proposals and who shall furnish the breakout procurement center representative with information regarding the disposition of any such proposal, and

g. review the systems that account for the acquisition and management of technical data within the procurement center to assure that such systems provide the maximum availability and access to data needed for preparation of offers to sell to the United States those supplies to which such data pertain which potential offerors are entitled to receive (3:19-20).

The breakout procurement center representative is also authorized to appeal a failure to act favorably on any recommendation made. The appeal must be in writing, and specifically recite the circumstances of the appeal and the basis of the recommendation. The appeal will be decided by an official at least one supervisory level above the person who initially failed to accept the recommendation. The appeal must be decided within 30 calendar days of its receipt (3:20).

III. Methodology

Overview

This chapter describes the research methodology used to accomplish the research objective and answer the research questions identified in Chapter I. Included in this chapter is a description of the data gathering process and the statistical analysis performed. The assumptions pertaining to the research methodology and a brief summary are presented last.

Data Collection

Through review of the literature and the breakout documentation maintained within the nine, two-letter organizations at ASD, the researcher developed a composite listing of factors that lead to a non-breakout decision. This list was then the subject of five unstructured interviews from a select group of professors from AFIT and breakout managers at ASD. Although the AFIT professors were not practicing breakout experts, they were familiar with breakout policies and procedures. Each interviewee was provided with the composite list, and comments were solicited as to it's completeness. Comments received were utilized in the formulation of the final composite listing. Completion of this list effectively accomplished research question number one.

Each two-letter organization was then contacted to identify the population of practicing breakout experts at

ASD. Selection criteria for this population was that the individual hold the position of SPO director. At ASD, some two-letter organizations have only one SPO director, while other "basket" two-letter organizations may contain several smaller SPOs, each headed by a SPO director. Although many individuals from several functional areas within the SPO provide recommendations in the breakout process, the final breakout decision rests with the SPO director. For this reason, it was determined that the SPO director would be the expert capable of providing the most valid data for this study.

With this population identified, the researcher conducted a structured interview with as many experts as possible. The purpose of this interview was to collect ordinal data by having each expert rank the composite listing of factors which lead to a non-breakout decision. Instructions were provided to assign a rank of one to the factor each individual considered to be most important, and so on until all factors had been consecutively ranked. Space was also provided for any written comments each expert had relating to completion of this task. Any and all comments received were taken into consideration during data analysis. Once all data had been gathered, the researcher performed a non-parametric statistical test to determine the level of expert agreement in the rankings.

Interviews. Both unstructured and structured interviews were used in the above data collection process. The unstructured interview is one in which the interviewer does little more than keep the interviewe 's comments focused on some topic (17:67). In this research, the topic centered on a discussion of identification of additional factors that may lead to a non-breakout decision. The greatest value of this technique lies in the depth and detail of information that can be secured (12:160). "Interviewers can note conditions of the interview, probe with additional questions, and gather supplemental information through observation" (12:160).

In contrast, the structured interview is one in which both the interview items (i.e. questions) and response possibilities available to the respondent are predetermined (17:67). This technique was employed when the breakout experts ranked the composite list of factors leading to a non-breakout decision. During this process, response possibilities were limited by the number of factors to be ranked; however, responses were not fully predetermined as a space for written comments was provided.

The major disadvantage of the interview process is bias that may be introduced into the data (12:165). Bias consists of numerous factors that deteriorate the accuracy of the data. For example, some of these factors include sampling error, age and authority of the interviewer, and

failure of the respondent to report fully and accurately (12:165-168). In this study, bias was limited by assuring each respondent of his anonymity, and using a collection technique that did not require open discussion with respondents when ranking the data.

Statistical Analysis

The technique used for statistical analysis was Kendall's coefficient of concordance, W. This technique provides "an index of the divergence of the actual agreement shown in the data from the maximum possible (perfect) agreement" (16:230). A high value of W is interpreted as meaning that observers are applying essentially the same standard in ranking the N objects under study (16:237). When using this statistic, the null hypothesis (Ho) is: the rankings of the items by the respondents are unrelated. The alternate hypothesis (Ha) is: the rankings of the items by the respondents are related (16:229-230).

In performing Kendall's test of concordance, the following steps were taken:

1. The null (Ho) and alternate (Ha) hypotheses were established:

    Ho: The rankings given to the factors leading to a non-breakout decision are unrelated.

    Ha: The rankings given to the factors leading to a non-breakout decision are related.

2. To evaluate the test, an alpha value of .05 was used. This value is the probability of rejecting the null hypothesis as being false, when this hypothesis is actually true (14:285).

3. Kendall's coefficient of concordance W, was then calculated using the following equation (16:231).

$$W = \frac{s}{(1/12)\ (k^2)\ (N - N^3)}$$

where,

s = sum of the squares of the observed deviations from the means of the sums

$$s = \sum(Rj - \sum Rj/N)^2$$

Rj = rank of the jth factor (leading to a non-breakout decision)

N = number of factors ranked

k = number of experts interviewed

4. If N is greater than 7, it can be stated that the test statistic W follows a Chi-Square distribution with N-1 degrees of freedom (16:236). The chi-square value for the ranks was calculated using the following formula:

$$\text{Chi-Square} = k(N-1)W$$

where,

k = number of experts interviewed

N = number of factors ranked

W = Kendall coefficient of concordance calculated in step 3

5. The chi-square value calculated above was then compared against the critical value contained in a Chi-Square table with the N-1 degrees of freedom (16:249). If the chi-square value is less than the critical value, the null hypothesis cannot be rejected. If the chi-square value is greater than the critical value, the null hypothesis can be rejected (16:236).

With the above analysis indicating expert agreement in factor ranking, prioritization of this data became very

meaningful. Prioritization was accomplished simply by summing the ranks given to each factor. The factor with the lowest sum was given a priority of one, and so on until all factors had been prioritized. Completion of this task effectively accomplisned research question number two.

Assumptions

1. The population of experts at ASD are representative of Air Force breakout experts.

2. Any factor leading to a non-breakout decision omitted in the study had no significant impact on the research results.

3. The respondents interpreted the factors in the composite listing in the same manner.

4. Anonymity was maintained by all respondents during the data collection process.

Chapter Summary

This chapter described the research methodology developed by the researcher to accomplish the research objective. The chapter identified the sources of data, methods of data collection, and techniques of data analysis.

ASD was selected as the research site, with the population of interest identified as those individuals who occupy the position of SPO director or higher.

Data collection consisted of identifying the factors which have lead to a non-breakout decision, and consolidat-

ing this information is the form of a composite listing questionnaire. This questionnaire was administered to the population of breakout experts to identify the importance of each factor to a breakout decision.

The researcher then performed a statistical test to determine the agreement in the rankings given by the experts. Kendall's coefficient of concordance, W, was used for this test. Using the methodology outlined in this chapter, the researcher will present the research findings in Chapter IV.

IV. Findings and Analysis

Overview

The purpose of this chapter is to present the research findings resulting from the data collected by the researcher using the methodology described in Chapter III. This chapter consists of two research phases, each structured to answer the two research questions and accomplish the overall research objective identified in Chapter I.

Research Phase I

Research phase I was designed to answer research question 1: What factors are associated with ineffective component and spare part breakout programs? In addition to gaining some insight into this question through the literature review performed in Chapter II, a review of the component breakout file documentation maintained by each of the nine two letter organizations at ASD was also conducted. The major thrust of this review was to investigate how actively each organization participated in the breakout process, and specifically identify the factors used to justify a non-breakout decision. The results of this review, broken out by each organization, is given below.

Deputy for Tactical Systems, ASD/TA. ASD/TA is a large organization consisting of several SPO's dealing with the tactical environment. Of these SPO's, only the F-15 SPO

maintained an active breakout program. As a result of a DoD IG report published on 20 August 1986, the F-15 SPO had recently considered 52 candidate item for breakout. Of these 52 items, 15 were selected for actual breakout with an estimated cost savings of $20,482,000 over the anticipated life of the program. Of the remaining 37 items not broken out, 17 were considered not to have adequate cost savings, 11 were considered technically unstable, 3 did not have sufficient lead time to produce adequate funding, 5 were items assembled from other parts and therefore produced no end item to breakout, and 1 component required redesign to accommodate other known changes to the aircraft.

Deputy for Propulsion, ASD/YZ. Due to the program phase of each of its major engine programs, with the exception of 11 minor items of support equipment, ASD/YZ did not have an active component breakout program for the following reasons:

a. F109 -- New engine just entering production. Small program driven by T-46 aircraft program status. Unless furtner requirements for this engine are identified, no potential for component breakout exists.

b. F100-220 -- New engine building up to full production. As production stabilizes breakout will be investigated during fiscal year (FY) 87.

c. F100-100 and -200 -- Both models have been transferred to AFLC for management responsibility.

d. F101 -- Multi-year buy program having benefits based on multi-year. Program currently has limited production expectations. No breakout benefits to be gained.

e. F110 -- New engine building up to full production. As production stabilizes breakout will be investigated during FY 87.

Deputy for Simulators, ASD/YW. ASD/YW does not manage a component breakout program for the following reasons:

a. Simulators are not bought under annual buys. Usually the development and total production buys are competed and procured under a single contract which severely limits breakout potential.

b. Simulator programs have been directed to convert from organic support to contractor logistics support (CLS) with a guaranteed availability rate. Equipment broken out and supplied by the government could adversely impact the guaranteed availability.

c. Most of the high dollar items that would meet the one million dollar threshold for consideration are aircraft computer, avionic, and computational systems. The functions of the aircraft computer and avionics systems are most often simulated rather than stimulated; therefore, the equipment is not needed. Furthermore, due to the dynamic nature of the computational systems configuration, these systems are not considered as viable breakout candidates.

d. Some of the simulator programs are procured as Aircrew Training Systems, where the Air Force is paying for a trained crew member, and not a simulator device. Component breakout in these programs is not considered.

Deputy for Aeronautical Equipment, ASD/AE. Due to the nature of equipment procured, ASD/AE supplies a large amount of GFE and inventoried components for incorporation into government purchased end items. As a result, most items broken out by AE are items maintained in the Air Force inventory. Consequently, the breakout program maintained by AE consists of identifying and supplying these inventoried parts to prime contractors. AE's largest program, the ACES II ejection seat, is already furnished as GFE to the F-15, F-16, B-1, and T-46 contractors by the respective aircraft SPOs.

Deputy for F-16, ASD/YP. ASD/YP has broken out and currently manages 14 items in their component breakout program. The potential estimated cost savings for these items could not be found on file. During the last YP component breakout review in September of 1985, 41 additional items were considered for breakout. Of these 41 items, all were eliminated from consideration because of unstable designs, quality and manufacturing problems, financial and technical risks, lack of required data, effect on logistics support, and excessive manpower requirements.

Deputy for Reconnaissance/Strike and Electronic Warfare Systems, ASD/RW. Review of ASD/RW component breakout files identified six components for possible breakout in 1986, but due to new designs, schedule concerns, and cost risks all were eliminated for actual breakout. Review of the applicability of component breakout of all six items will periodically occur during the acquisition cycle to determine if the technical risk to the government decreases to an acceptable level to initiate breakout.

Deputy for Strategic Systems, ASD/YY. Since most major programs managed by ASD/YY are in the last stages of production, or relatively new with a high probability of design change, breakout activity within the organization has centered in the area of support equipment since the late 1970's. In 1986, YY identified 11 items of support equip-

ment for breakout and local manufacture. Five additional items were also considered at that time, but all were eliminated due to technical complexity, and a lack of required data needed for breakout.

Deputy for Airlift and Trainer Systems, ASD/AF. Of the 13 major programs managed by ASD/AF, only two, the T-46, and Combat Talon II, have been reviewed for breakout potential. The program office contends that by AFSCR/AFLCR 800-31 dated 31 May 1985, breakout reviews are only necessary for programs with production acquisition request for proposals (RFPs) released in that fiscal year. Since the RFPs for the 11 other programs were released prior to the direction given by AFSCR/AFLCR 800-31 in 1985, breakout reviews were not considered necessary for these programs. This interpretation is in error, as AFSCR/AFLCR 800-31 clearly states that annual breakout reviews will be conducted prior to the release of the production acquisition RFP. In any event, ASD/AF performed no breakout reviews on the remaining 11 programs due to the errant justification sited above.

The T-46 program, however, was committed to component breakout from its inception. The program went on contract with a significant amount of GFE. This GFE included nearly 100 per cent of the aircrafts avionics, 90 per cent of the support equipment, 50 per cent of instrument, electrical and mechanical subsystems, and several engine components. In addition, since the production contract, over 100 items have

been examined for breakout potential. Of these items, only the ACES II ejection seat has been selected for breakout. All otner items were excluded due to uncertainty of design, and/or lack of reprocurement data.

The Combat Talon II program has also participated in some minor breakout activity. This program has taken the unique approach of breaking out some of its required shipping containers, in addition to the more conventional breakout of support equipment. Design instability again appeared to the major reason discouraging more breakout for this program.

Deputy for B-1B, ASD/B-1. Regulatory guidance provided for component breakout does not pertain to the B-1B program. The B-1B is somewhat unusual in several respects relevant to the component breakout process, as follows:

a. The program is limited to production of 100 aircraft, plus associated installed equipment, spares, support equipment, etc. No further production is planned or authorized.

b. All 100 aircraft and installed systems, and a large number of spares and support equipment, are currently on contract. Aircraft, avionics and engine production for all aircraft was initiated several years ago under expanded advance buy (EAB) and multiyear procurement (MYP) contracts recently definitized. This procurement environment is counter to the annual breakout reviews required by regulation.

Due to this procurement strategy, the components for breakout in the B-1B SPO were identified during a single review very early in the program. An extensive review of hundreds of aircraft components resulted in selection of

seven major aircraft systems for breakout. Major reasons given for a non-breakout decision included component complexity, rigid schedule requirements, evolution in component design, and lack of reprocurement data. No breakout reviews have been held in the B-1 SPO since the breakout of the seven aircraft systems mentioned above.

This review of the component breakout documentation maintained at ASD in conjunction with the literature review accomplished in Chapter II, resulted in the preliminary composite list of factors used to justify non-breakout decision shown in Table I.

TABLE I

Preliminary List of Factors
Used to Justify a Non-Breakout Decision

1. Insufficient technical stability
2. Insufficient leadtime/schedule constraints
3. Insufficient cost savings
4. Risk to the government to high
5. Insufficient manpower for increased management responsibility
6. Insufficient data/specifications required for reprocurement
7. Safety restrictions
8. Quality/manufacturing problems
9. Limited procurement fund availability
10. Insufficient regulatory guidance
11. Component warranty restrictions
12. Component complexity to high

This list became the subject of 5 unstructured interviews with a group consisting of 4 component breakout experts at ASD, and one professor at the Air Force Institute of Tecnology (AFIT). The selection of interviewees was based on

their knowledge of component breakout policies and procedures. These five individuals were provided with the above list, and comments were solicited regarding the comprehensiveness and clarity of terms. While none of the experts recommended adding or deleting items from the list, some rewording was recommended for added clarity. This rewording resulted in the final list of factors used to justify a non-breakout decision shown in Table II.

TABLE II

Final List of Factors Used
to Justify a Non-Breakout Decision

1. Lack of technical stability
2. Lack of leadtime/schedule constraints
3. Insufficient cost savings
4. Excessive program risk
5. Lack of manpower for increased management responsibility
6. Lack of data/specifications required for reprocurement
7. Safety restrictions
8. Quality/manufacturing problems
9. Lack of timely procurement fund availability
10. Insufficient regulatory guidance
11. Component warranty restrictions
12. Component complexity to high

Completion of the above list effectively answered research question 1.

Research Phase II

Research Phase II was designed to answer Research Question 2, what factors are most important in the development of a breakout decision? To accomplish this task, the researcher developed a questionnaire incorporating the

composite list of factors justifying a non-breakout decision shown in Table II. The purpose of the questionnaire was to obtain individual rankings of the importance of each factor to a breakout decision by component breakout experts. The questionnaire given to each breakout expert is shown in Appendix A.

As explained in Chapter III, the population of interest for this questionnaire were individuals who held the position of SPO director. At ASD, this was a population of 24 individuals. Of this population, 8 of individuals responded that they had never been responsible for a breakout decision, and disqualified themselves from this study. The questionnaire was completed by the remaining 16 SPO directors at ASD. These 16 experts provided the ranked data shown in Table III.

Kendall's Coefficient of Concordance, w, Test. The null hypothesis (Ho) established for Kendall's test of concordance is: the expert rankings given to the factors used to justify a non-breakout decision are not related. The alternate hypothesis (Ha) is: the expert rankings given to the factors used to justify a non-breakout decision are related.

The actual computations involved in the analysis are presented as follows:

W = Kendall's Coefficient of Concordance $0 < W < 1$

k = the number of experts interviewed (16)

N = the number of factors ranked (12)

TABLE III

Component Breakout Expert Rankings of Importance of Factors Used to Justify a Non-breakout Decision

	Factors (see Table II, page 35)											
	1	2	3	4	5	6	7	8	9	10	11	12
Experts												
1	7	4	1	8	3	2	11	10	5	12	9	6
2	3	5	7	1	8	10	4	11	2	12	6	9
3	5	3	6	1	2	11	12	10	8	9	7	4
4	1	5	10	2	9	4	3	6	11	12	7	8
5	5	4	3	1	6	8	2	9	11	12	10	7
6	3	1	4	6	9	8	7	10	2	12	11	5
7	4	7	8	1	3	6	2	9	11	12	10	5
8	1	7	10	2	8	3	12	5	9	11	4	6
9	2	3	4	1	10	7	6	8	5	12	9	11
10	4	5	2	1	8	6	3	11	8	12	9	10
11	3	2	12	1	7	8	9	10	6	11	4	5
12	1	4	3	5	8	2	7	12	9	10	11	6
13	12	1	4	2	3	9	11	5	6	8	7	10
14	2	5	6	4	10	1	11	9	7	12	8	3
15	2	4	3	1	7	5	10	9	8	12	11	6
16	9	6	8	7	5	11	1	2	10	12	3	4
Sums	64	66	91	44	106	101	111	136	118	181	126	105
Rank	2	3	4	1	7	5	8	11	9	12	10	6

Mean Sum = 104.08

s = sum of the squares of the observed deviations from the means of the sums obtained from table III.

$$s = \sum (R_j - \sum R_j/N)^2$$

$$s = (64-104.08)^2 + (66-104.08)^2 + (91-104.08)^2 + (44-104.08)^2 + (106-104.08)^2 + (101-104.08)^2 + (111-104.08)^2 + (136-104.08)^2 + (118-104.08)^2 + (181-104.08)^2 + (126-104.08)^2 + (105-104.08)^2 = 14,518$$

$$W = \frac{s}{(1/12)\ (k^2)\ (N^3-N)} = \frac{14,518}{36,608} = .3966$$

Since N is greater than 7, the test statistic W follows the Chi-Square distribution with N-1 degrees of freedom. The following formula may then be used to compute a value of chi-square whose significance for N-1 degrees of freedom may be tested.

Chi-Square Value = (k)(N-1)(W) = (16)(11)(.3966) = 69.8

The test chi-square value at the 99.5 per cent level of confidence based on 11 (N-1) degrees of freedom = 26.7569 (see Appendix B for Chi-Square table of critical values). Since the calculated chi-square value of 69.8 exceeds the critical value of 26.7569, the null hypothesis is rejected. This analysis concludes that the experts agreed on the

importance of factors justifying a non-breakout decision. A summary of the factors listed in order of importance is shown in Table IV.

TABLE IV

Summary of Expert Importance Rankings

Rank	Factor Justifying a Non-Breakout Decision
1.	Excessive program risk
2.	Lack of technical stability
3.	Lack of leadtime/schedule constraints
4.	Insufficient cost savings
5.	Lack of data/specifications required for reprocurement
6.	Component complexity to high
7.	Lack of manpower for increased management responsibility
8.	Safety restrictions
9.	Lack of timely procurement fund availability
10.	Component warranty restrictions
11.	Quality/manufacturing problems
12.	Insufficient regulatory guidance

Completion of this list effectively answered research question 2.

Findings for Research Question One

In order to answer research question one, data collection was directed at identifying the factors used to justify a non-breakout decision. Collecting this data through literature review, and review of the file documentation of component breakout activity maintained at ASD, uncovered the following corollary findings.

First Corollary Finding. There was a large disparity in the amount of breakout activity within the various SPO's

at ASD. Some SPO's aggressively managed a very active breakout program, while others did not consider breakout a major priority.

Second Corollary Finding. The number of factors used to justify a non-breakout decision and amount of file documentation maintained varied greatly between the SPO's. Some SPO's kept extensive files detailing the results of each breakout decision, while others maintained very limited information.

Third Corollary Finding. Subjective regulatory guidance in the area of cost savings lead to inconsistent breakout decisions between the SPO's. For example, regulations state that an item should be considered for breakout if sufficient cost savings exist. Subjectivity in what is considered sufficient cost savings between the SPO's lead to inconsistent breakout decisions in some cases.

Findings for Research Question Two

In order to answer research question two, the data collection process consisted of requesting SPO directors to rank the factors leading to a non-breakout decision in order of importance. A comment section was provided on the questionnaire administered to these experts, which resulted in the following corollary findings.

First Corollary Finding. One SPO director commented that component breakout has not been a success for this program. A number of changes in the items induced by the parallel nature of the program (full scale development in conjunction with production) have resulted in cost increases beyond any projected cost savings.

Second Corollary Finding. Anotner comment noted that the factor "excessive program risk" should be reworded to read "risk to weapon system performance -- primary mission."

Third Corollary Finding. A third comment said that the factor "quality/manufacturing problems" in many cases is not known until the new firm chosen to produce the item has been awarded the contract. This problem is then uncovered when the new manufacturer produces poor quality components, or can not meet delivery schedules.

CHAPTER SUMMARY

Chapter IV has followed the steps of the problem solving methodology developed in Chapter III to answer the two research questions and satisfy the overall research objective. Corollary findings resulting from this research were also presented. In the final chapter, conclusions and recommendations resulting from this study will be presented.

V. Summary, Conclusions, and Recommendations

Overview

The purpose of this chapter is to summarize the research performed to accomplish the research objective, draw conclusions about the research findings, and present recommendations. Specifically, the research process undertaken to answer the two research questions form the main sections of this chapter. A summary of the research will be presented followed by conclusions about the research findings for each research question. Recommendations resulting from this study, and for future research in this area will be presented last.

Summary for Research Question One

Two reviews combined to answer research question one. First a thorough literature review of the history and development of component breakout provided insight into the factors used to justify a non-breakout decision. A second review of the component breakout file documentation maintained at ASD provided additional insight, and lead to the development of a composite list of factors used to justify a non-breakout decision. This composite listing was reviewed for completeness, using unstructured interviews, by five component breakout experts. Although these interviews did not result in any additions or deletions, the experts recommended rewording of some of the factors resulting in the

final list shown in Table II.

Conclusions for Research Question One

The two reviews described above produced a complete and comprehensive list of factors used to justify a non-breakout decision. None of the five component breakout experts interviewed recommended any additions or deletions to the list. Although one comment received stated that program risk is inherent in each of the factors, all five interviewees agreed that the factor "excessive program risk" should remain a separate item on the composite list.

First Corollary Finding. The researcher found a large disparity in the amount of breakout activity within the various SPO's at ASD. Altnough some SPO's are much larger with significantly more breakout potential, breakout is all but ignored in several offices. Many SPO's were unfamiliar with or overlooked the regulatory requirement to perform annual component breakout reviews.

Second Corollary Finding. File documentation maintained on component breakout varied greatly throughout ASD. Some SPO's exhibited a detailed analysis to include estimated cost savings on each item considered for breakout, while others kept very limited documentation on their breakout decisions. No standard review process existed among the SPO's when making a component breakout decision.

Third Corollary Finding. Subjective regulatory guidance in the area of cost savings lead to inconsistent breakout decisions among the SPO's. Regulations cite sufficient cost savings as one of the requirements needed to justify a breakout decision. However, since no dollar amount is specified, each SPO has it's own interpretation on what sufficient savings are. Consequently, some SPO's would break an item out to save a specific amount, while this same savings would not justify breakout in other offices.

Summary for Research Question Two

SPO director rankings of the composite list of factors in order of importance in a breakout decision, provided the necessary data to answer research question two. Using a questionnaire to obtain these rankings, a statistical analysis based on Kendall's Coefficient of Concordance revealed a high degree of expert agreement in the rankings. This resulted in the list of factors, prioritized in order of importance to a breakout decision, shown in Table IV.

Conclusions for Research Question Two

Eight of the sixteen SPO directors providing input into this study ranked "excessive program risk" as the most important factor when making a breakout decision. With management responsibility for todays complex systems in his hands, the SPO director strongly desires to keep as much risk on the contractor as possible. Regardless of the

potential cost savings involved, the increased risk inherent in the breakout process is a strong deterrent when considering the intense pressure placed on meeting a production/delivery schedule for a major weapons system.

First Corollary Finding. Success of any component breakout program is based on careful review of the components under consideration. The most successful breakout candidates are those high cost reliable items that are not likely to require changes in design. In the early stages of a program, fluctuation in design is likely to occur. Consequently, candidates broken out early in the program may not provide the estimated cost savings.

Second Corollary Finding. To clarify and further stress the importance of risk in the breakout process, one SPO director commented that the factor "excessive program risk" should be reworded to read, "risk to weapon system performance -- primary mission". For example, the breakout of mission essential components such as fighter aircraft radar equipment, if not managed properly, may jeopardize the primary mission of the aircraft. Successful fielding of these highly complex type components is best assured through prime contractor management, and breakout of these items is most often not recommended.

Third Corollary Finding. The factor "quality/manufact-

uring problems" was ranked 11 out of 12 in overall importance. Although this is a very important factor in the breakout decision process, in most cases these problems are uncovered subsequent to the breakout decision. This is to say, poor quality/manufacturing is not readily apparent until the firm begins delivery. Since this information is not available when the breakout decision is made, most experts placed it far down the list in order of importance.

RECOMMENDATIONS

Stress Regulatory Guidance. Some SPO's are ignoring or are completely unfamiliar with regulatory guidance for component breakout. AFSC must recognize this and provide updated policy stressing the importance of component breakout and its potential cost savings. Until more high level attention is placed on the subject, component breakout will not produce maximum cost savings.

Fully Document Breakout Decisions. AFSC should formulate standard guidance for fully documenting all breakout decisions, to include estimated cost savings. This policy will force SPO's to perform more detailed breakout reviews, and result in better breakout decisions and increased cost savings.

Standardize Procedure for Calculating Cost Savings. AFSC should provide a standard procedure for calculating the cost savings realized from component breakout. As it now

stands, regulations recommend a component for breakout if it results in sufficient cost savings. Since sufficient cost savings is not defined, each SPO has its own interpretation as well as its own method for calculating estimated cost savings. A standard method of calculating cost savings, and amount of cost savings required must be established to monitor and enable consistent breakout decisions.

Incentivize Component Breakout. As previously stated, the increased risk inherent in the breakout process is the major deterrent to increased breakout activity. Consequently, AFSC should provide greater incentives to todays program managers to more aggressively pursue an active breakout program. If breakout activity is to be increased, the Air Force must establish motivational programs and reward structures which provide positive incentives to the work force. As reported in Chapter I, inspecting agencies have little difficulty identifying components with great breakout potential that program managers have somehow "overlooked". More high level attention, in conjunction with greater incentives, would profoundly increase the amount of component breakout and resulting cost savings.

Replication of this Study. In an effort to establish greater confidence in the research results, replication of this study is recommended at other AFSC product divisions (ESD, SD, AD), or for AFSC as a whole. The replication

would identify if the same or similar factors were used to justify a non-breakout decision, and if the individual rankings of importance are tne same. Another researcher may also uncover new factors and provide more recommendations to increase component breakout, and its related cost savings.

Appendix A: Questionnaire

Instructions:

1. The following is intended to be a composite listing of factors used to justify a non-breakout decision.

2. Please rank the following twelve factors in decending order of importance to a breakout decision.

3. A rank of one should be given to most important factor justifying a non-breakout decision with the remaining factors consecutively ranked until a rank of twelve has been given to the least important factor.

Factors Used to Justify a Non-breakout Decision

____ 1. Lack of technical statility

____ 2. Lack of leadtime/schedule constraints

____ 3. Insufficient cost savings

____ 4. Excessive program risk

____ 5. Lack of manpower for increased management responsibility

____ 6. Lack of data/specifications required for reprocurement

____ 7. Safety restrictions

____ 8. Quality/manufacturing problems

____ 9. Lack of timely procurement fund availability

____ 10. Insufficient regulatory guidance

____ 11. Component warranty restrictions

____ 12. Component complexity to nign

Comments/Suggestions: (please use back if necessary)

Appendix B: Abbreviated Chi-Square Table

TABLE V

Chi-Square Table

Degrees of freedom	Level of Significance .100	.050	.025	.010	.005
10	15.9871	18.3070	20.4831	23.2093	25.1882
11	17.2750	19.6751	21.9200	24.7250	26.7569
12	18.5494	21.0261	23.3367	26.2170	28.2995
13	19.8119	22.2621	24.7356	27.6883	29.8194
14	21.0642	23.6848	26.1190	29.1413	31.3193

Source: (14:899)

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The purpose of this study was to investigate why component breakout is not more extensively used as a cost saving technique in U.S. Air Force procurements. To accomplish this a review of the literature, and component breakout documentation maintained at Aeronautical Systems Division (ASD) was completed. These reviews resulted in a composite list of twelve factors used to justify a non-breakout decision. Sixteen System Program Office (SPO) directors were then asked to consecutively rank the factors in order of importance to a breakout decision. A rank of one was given to the most important factor with the least importanct receiving a rank of twelve. Overall importance was then determined by summing the ranks given to each factor. The factor with the lowest sum was considered to be most important and so on until the factor with the highest sum was identified as the least important.

A nonparametric statistical test was conducted on this ranked data to determine the level of agreement between the SPO directors of the relative importance of each factor. The results of this test indicated a high level of agreement among the SPO directors on the overall importance of each factor in a breakout decision.

The most important recommendation produced from this study was that the Air Force must provide greated incentives to SPO directors to more aggressively pursue an active component breakout program. Only through increased high level support will the considerable cost savings available through component breakout be fully realized.

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